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A novel fuzzy logic controller for vector controlled induction motor drive

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Abstract

In this paper, a novel fuzzy logic controller is proposed for vector controlled three phase induction motor. Modelling of the three phase induction motor is done with the help of governing modelling equations. Initially PID controller is interfaced with the induction motor model. Performance of the induction motor with PID controller is analysed under disturbance environment. Speed controller action of this PID controller is found to be poor under disturbance environment. Besides, fuzzy logic based speed controller is interfaced with the three phase induction motor. Performance of the induction motor with fuzzy logic controller under disturbance environment is examined. This fuzzy logic controller overcomes the drawbacks of the conventional PID controller. Tracking performance of this fuzzy logic controller is scrutinized in the disturbance environment. Superior speed controller action is achieved by the proposed fuzzy logic based speed controller for the three phase induction motor.

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Keywords: Neural network controller, Fuzzy logic controller, Load torque, Membership function.

1. Introduction

Three phase induction motor speed control is necessary in most of the industries now a days. Besides, performance of the three phase induction motor under various speeds is an issue when an improper controller is connected. Particularly in the disturbance environment conventional controller is not suitable for controlling the three phase induction motor. Therefore, this study aims to propose a robust controller for the three phase induction motor. In order to identify the robust controller for the three phase induction motor initially three phase induction motor is controlled by PID controller under disturbance environment such as voltage sag and voltage swell.

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Performance of the PID controller is estimated interms of settling time, steady state error. Then three phase induction motor is controlled by fuzzy controller under disturbance environment such as voltage sag and voltage swell. Performance of the fuzzy controller is estimated interms of settling time, steady state error. Moreover, the speed control action delivered by PID and fuzzy controller is compared interms of control system parameters.

Nomenclature

ω	Angular frequency
T_e	Electric torque
Phir	Rotor flux
T_m	Load torque

2. Methodology

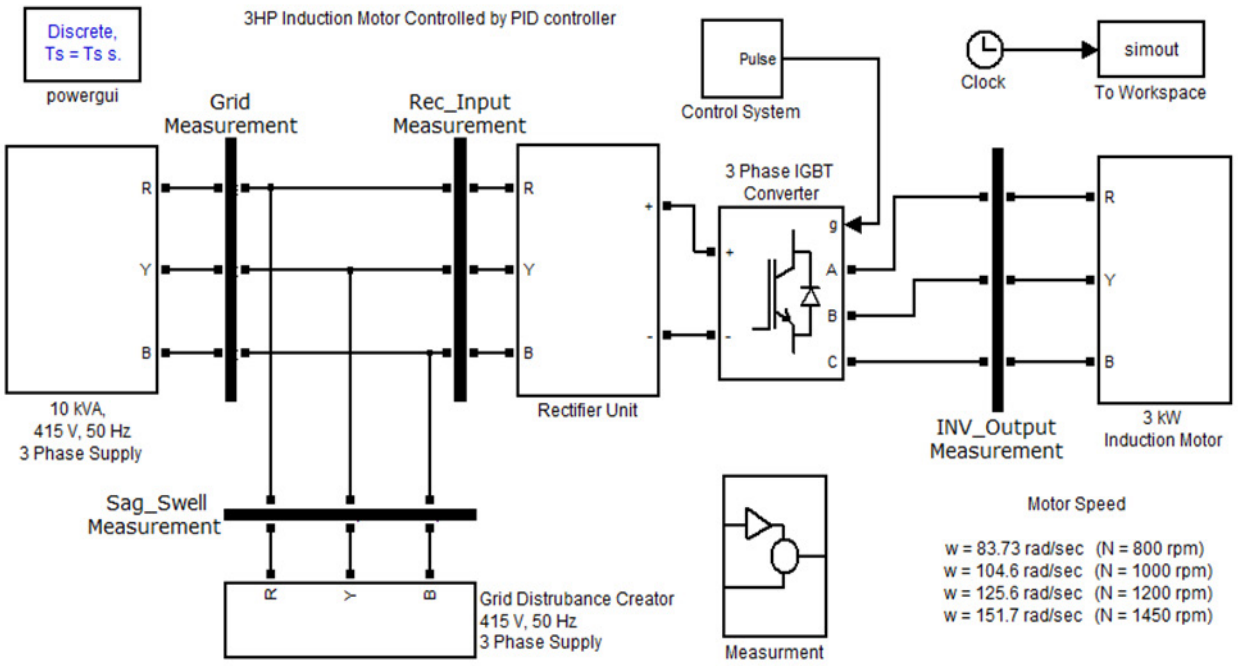

Fig (a) Block diagram of PID controller for the three-phase induction motor

Block diagram of PID controller for the three-phase induction motor is shown in fig (a). In this diagram, 10KVA, 3Φ, 415V, 50Hz supply is used as a source. This 415V ac supply is feeded to the rectifier via measurement unit. This measurement unit measures the voltage which is delivered by the 3Φ ac source. This 3Φ ac output is mixed with the disturbance signal which is having voltage sag and voltage swell signal. Moreover, this mixed voltage is rectified and fed to 3Φ inverter input. Three phase inverter produces the 3Φ ac signal based on the pulses (sinusoidal pulse width modulation) which it gets as input. Three phase inverter output is fed to the three-phase induction motor.